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Subject: Integration Guide – Mizar Radio Module 915 MHz

Integration Guide

Mizar Radio Module 915 MHz

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Document history

Date	*Author*	*Notes*
April 19th, 2012	Davide Carli	Initial draft
May 2nd, 2012	Davide Carli	Added details on test command(s) 0x86
May 31th, 2012	Davide Carli	In-depth documentation of test commands
July 18th, 2012	Davide Carli	Added data on current consumption in DEEP SLEEP status
April 15th, 2013	Davide Carli	Updated the description of some test commands
December 20th, 2013	Davide Carli	Document splitted in 433 MHz and 915 MHz versions RF Characteristics updated according to FW 2.01A and 2.01B Removed outdated information
January 15th, 2014	Davide Carli	RF Characteristics updated according to FW 2.02B
February 11th, 2014	Pier Giorgio Peruzzi	Added Operational description and Interface description

Regulatory

FCC regulation

Interference warning

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. *This device may not cause harmful interference, and*
2. *This device must accept any interference received, including interference that may cause undesired operation.*

Any change or modification to the product not expressly approved by Datalogic ADC S.r.l. could void the user' s authority to operate the device.

FCC RF Radiation Exposure Statement

To comply with FCC RF exposure compliance requirements, for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter

Antennas

This radio transmitter may only operate using the antennas certified as listed in this document at Clause "Antenna".

Industry Canada regulation

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante

and:

This radio transmitter (identify the device by certification number, or model number if Category II) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (identifier le dispositif par son numéro de certification ou son numéro de modèle s'il fait partie du matériel de catégorie I) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

RF Radiation Exposure Statement

To comply with IC RF exposure compliance requirements, for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter

Exposition aux radiations RF

Afin de se conformer avec les exigences de conformité de l'exposition RF, pour des configurations mobiles, une distance de séparation d'au moins 20 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes. Ce dispositif ne doit pas être co-située ni fonctionner en conjonction avec une autre antenne ou transmetteur

Antennas

This radio transmitter (MIZAR Radio Module 915MHz) has been approved by Industry Canada to operate with the antenna types ***listed below****. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.*

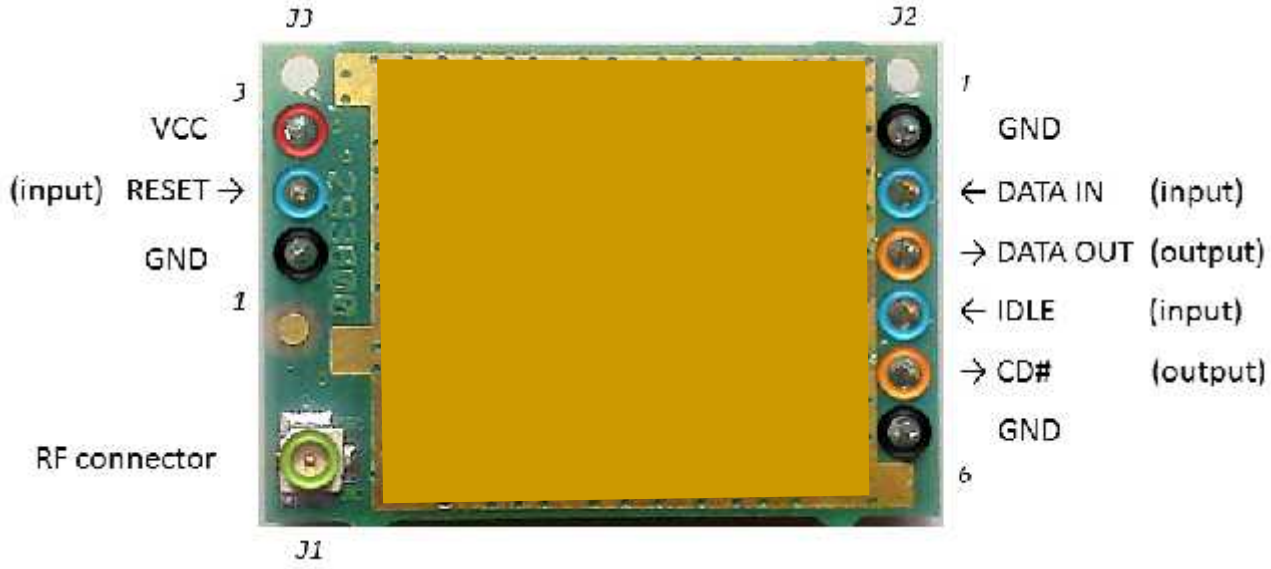
Antennes

Cet émetteur radio (Radio MIZAR Module 915MHz) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous. Types d'antennes pas figurent dans cette liste, ayant un gain supérieur à le gain maximum indiqué pour ce type, sont strictement interdites pour une utilisation avec cet appareil.

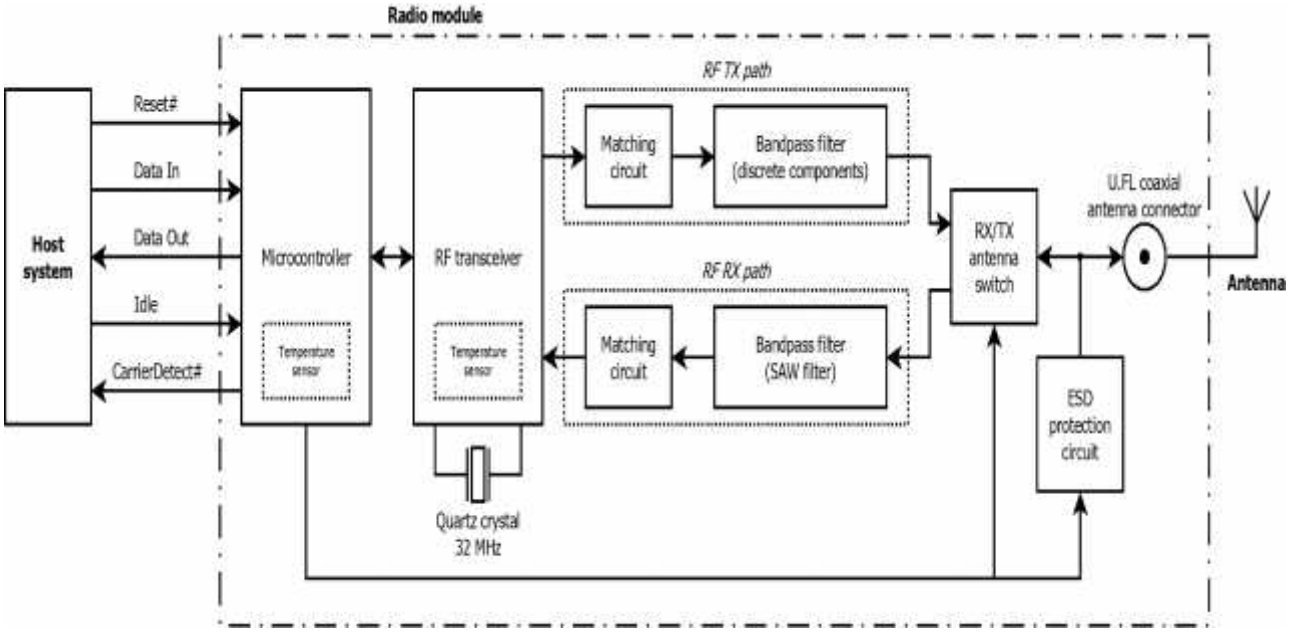
Introduction

Mizar radiofrequency (RF) module operates in the 902-928 MHz ISM frequency band.

Pinout



Block diagram



Antennas

The module has been approved with the antennas listed below:

- Datalogic, part number 663316020 – 902-928 MHZ Helical Antenna – gain 1dBi, impedance 50Ω
- Antenna Factor, model ANT-916-CW-QW – gain 3dBi, impedance 50Ω
- Bondale Electronics, model G-RA0K14155047 – gain 1dBi, impedance 50Ω
- Datalogic, part number ANTENNA CABLE GM4100-910 – gain -4,5dBi, impedance 50Ω

Operational description

The equipment is a radio module to be integrated inside cordless devices.
It is based upon an FSK (Frequency Shift Keying Modulation) Half-Duplex transceiver working in the ISM band from 902 to 928 MHz.
The radio module has a UART interface to exchange data and commands.

Working modes

Radio module can operate in the follow working modes :

- Low Speed, Low Power, fixed channel (among 25 channels)
  - FSK, Bitrate 36864 bps, RZ Manchester encoded, Frequency deviation +/- 75KHz
- Low Speed, Frequency Hopping Mode over 25 channels
  - FSK, Bitrate 36864 bps, RZ Manchester encoded, Frequency deviation +/- 75KHz
- High Speed, Digital Transmission Mode, fixed channel (among 12 channels)
  - FSK, Bitrate 500,000 bps, NRZ, Frequency deviation +/- 220KHz
- High Speed, Digital Transmission + frequency agility Mode over 12 channels
  - FSK, Bitrate 500,000 bps, NRZ, Frequency deviation +/- 220KHz

Default mode after power-up is Low Speed Low Power mode.
Radio module can receive commands to allow to change its working mode.

Functional states

Radio module can be set in one of the following states during operation:

Idle State

Radio module stays in low power receiving mode with a limited capability to receive data. RF transmission is not allowed while radio is set in Idle state.

Receive State

It is the normal default state. In this state the radio receives the RF packets, decodes the packets and sends them to the Host device. In this mode the transceiver checks continuously the RF signal and demodulates it. The demodulated and filtered signal is sent to the microcontroller inside the radio module which

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decodes it and sends decoded data to the Host by means of the UART interface. Only valid demodulated data packets are sent to the Host.

Transmission State

This state is enabled from the host when it needs to transmit data. The transmission state is enabled sending a data packet to the radio module over the UART interface. The microcontroller in the radio module checks for the integrity of the data packet and enables the transceiver to modulate and transmit to the RF interface, preceded by a short preamble burst. Radio module exits automatically from this state when the complete packet has been transmitted, and returns to the receive state.

Radio module operates in CSMA-CA (carrier sense multiple access – collision avoidance) : transmission is enabled when the RF channel is not busy by the use of a "carrier detect" function. Radio module accesses the channel in a fair way using a backoff algorithm.

Interface description (pinout reference)

UART 2-pin interface, used to exchange data from the Host:

DATA_OUT (output pin) : transmits data to Host.

DATA_IN (input pin) : receives data from Host.

CD# – (output pin) Carrier Detect :

When radio is in receive mode, this pin signals the presence of RF carrier.

IDLE - (input pin) :

A high level on this pin forces the radio module in Idle State.

RESET (input pin) :

A low level on this pin resets the radio module.

VCC and GND :

Radio module power supply.

RF Port :

Radio Frequency Connector for the antenna.

Electrical characteristics

Table 1

Parameter	Min.	Typ.	Max.	Unit
Power supply voltage (between VCC pin and GND pin)	3,1	3,3	3,6	V
Operating temperature range	-30	---	+85	°C

RF characteristics

Low speed mode

Table 2

Parameter	Typ. value	Unit
Modulation	RZ Manchester	
Bit rate (over-the-air)	36864	bit/s
Frequency deviation	± 75,000	kHz
Number of supported channels	25	
Index of default channel	8	
Center frequency of default channel	910,00000	MHz

Table 3

Channel index	Channel center frequency [MHz]
1	902,80050
2	903,82900
3	904,85750
4	905,88600
5	906,91450
6	907,94300
7	908,97150
8	910,00000
9	911,02850
10	912,05700
11	913,08550
12	914,11400
13	915,14250
14	916,17100
15	917,19950
16	918,22800
17	919,25650
18	920,28500
19	921,31350
20	922,34200
21	923,37050
22	924,39900
23	925,42750
24	926,45600
25	927,48450

High speed mode

Table 6

Parameter	Typ. value	Unit
Modulation	NRZ	
Bit rate (over-the-air)	500000	bit/s
Frequency deviation	± 220,000	kHz
Number of supported channels	12	
Index of default channel	4	
Center frequency of default channel	910,00000	MHz

Table 7

Channel index	Channel center frequency [MHz]
1	903,64900
2	905,76600
3	907,88300
4	910,00000
5	912,11700
6	914,23400
7	916,35100
8	918,46800
9	920,58500
10	922,70200
11	924,81900
12	926,93600